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ABSTRACT

The present demand for quantitative proficiency makes low mathematics achievement not only a formidable obstacle in occupational aspirations but also in the academic arena. To modify the current understanding of the problem of mathematics anxiety and to develop an effective treatment program, college students (12 subjects per group; 8 females, 4 males) were randomly assigned to one of three groups: systematic desensitization, hypnotherapeutic restructuring, or an expectancy control group. A pretreatment and posttreatment administration of the Mathematics Anxiety Rating Scale and the Revised Math Attitude Scale were used as dependent variable measures of math anxiety and math attitude. Additionally, developmental mathematics course grades were used as a math performance measure. The results showed that at the end of the 6-week posttesting period, all three groups produced significant improvement in math anxiety levels. Only the hypnotherapeutic restructuring treatment created significant positive changes in attitude toward mathematics and, by the end of the 12-week grading period, produced significant improvement in math performance. The results suggest that math anxiety is a developmental-organizational disability generally accompanied by an avoidance reaction. (KGB)

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HYPNOTHERAPEUTIC RESTRUCTURING AND SYSTEMATIC DESENSITIZATION AS TREATMENT FOR MATHEMATICS ANXIETY

PAPER PRESENTED AT THE SOUTHWESTERN PSYCHOLOGICAL ASSOCIATION. THIRTY-FIRST ANNUAL CONVENTION 1985.

by

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HYPNOTHERAPEUTIC RESTRUCTURING AND SYSTEMATIC DESENSITIZATION AS TREATMENT FOR MATHEMATICS ANXIETY

In the advent of the increasing development of industrial-technological societies, the role of mathematics has become a critical factor in pursuit of many existing and emerging occupational fields. It is this present environmental demand for quantitative proficiency which profiles low mathematics achievements, not only as a formidable obstacle to occupational aspirations, but also as a serious problem in the academic arena.

The intention of the present study was two-fold. First, due to the unsatisfactory results of past and present mathematics anxiety treatment programs, to modify the current understanding of the problem by proposing a new conceptual model of mathematics anxiety. Second, to develop a treatment program predicated upon the new model and compare the new treatment program's effectiveness for lowering math anxiety, changing attitude, and improving math performance as an index of the new model's validity.

Three treatment programs, systematic desensitization (SD), hypnotherapeutic restructuring (HR), and an expectancy control group (EC) were compared using three dependent variables: (a) math anxiety, (b) attitude toward mathematics, and (c) math performance. Volunteer

subjects recruited from the math department at East Texas State University (who scored above 178 on the Mathematics Anxiety Rating Scale (MARS)) were randomly assigned to one of the three treatment conditions (12 subjects per group (8 females and 4 males)). A pre-treatment and posttreatment administration of the MARS and the Revised Math Attitude Scale (RMAS) were used as dependent variable measures of math anxiety and math attitude respectively. Additionally, developmental mathematics course grades were used as a math performance measure.

Treatment Group A, the systematic desensitization treatment, began with a standard Wolpe Muscle Relaxation technique. The subjects were instructed to close their eyes and focus on relaxed feelings within their bodies. In a soft voice, the relaxation instructions were given, as illustrated from the following excerpt:

> Settle back as comfortably as you can. Let yourself relax to the best of your ability . . . . Now, as you relax like that, clench your right fist, just clench your fist tighter and tighter, and study the tension as you do so.

The first session focused primarily on the relaxation training while the remaining four sessions were devoted to the six scene, anxiety desensitization hierarchy. This program was developed by Richard M. Suinn (1972) and consists of five prerecorded cassette tapes which use a reciprocal inhibition technique, or the pairing of deep muscle relaxation with invitro mathematics anxiety arousing situations. This program appears to be an excellent treatment package for mathematics anxiety as measured by the MARS and can be administered individually or within a group setting.

There were no instructions nor encouragement given to practice relaxation techniques between treatment sessions. The average administration time per session was 35 minutes. Richard M. Suinn's program of

systematic desensitization for mathematics anxiety constituted the desensitization treatment used.

The Hypnotherapeutic restructuring treatment (Group B) consisted of five 30 minute prerecorded cassette sessions. Each of the first four treatment sessions focused upon one of the four corresponding treatment constructs: (a) to teach focus of attention and ego strengthening, (b) to relate mathematical concepts and experiences to the individual's environment, (c) to build positive associations to numbers and testing situations, and (d) to restructure past mathematic experiences.

The fifth and final treatment session was primarily a review and summary of the first four treatments: a series of posthypnotic suggestions designed to enhance the restructuring technique and the termination of the hypnotic intervention.

Treatment Group C, the expectancy control group, received a prerecorded placebo treatment. The first treatment consisted of 25 minutes of prerecorded music preceded by a five-minute prerecorded statement outlining the benefits of subliminal cueing. The subjects were told that the basis of mathematics anxiety lies within the realm of the unconscious mind. Therefore, the most appropriate technique is to alter the unconscious math anxiety patterns by delivering corrective instructions to the unconscious at a subliminal level (nonauditory sound level). Naturally, there were no such subliminal instructions, only prerecorded music. All subjects involved in the study were mailed a copy of the results and the expectancy control group (Group C) was additionally debriefed in a follow-up letter. It was explained that the expectancy to improve was often responsible for observed improvement and that any positive therapeutic effect within their group was due to this expectancy and not to a bogus subliminal cueing procedure. This

single-blind procedure was used as a control for the expectancy effect inherent in treatment programs using human subjects.

Following the treatment procedure, statistical analysis consisted of a Lindquist Type III factorial design for math anxiety and attitude; a Lindquist Type I trend analysis was used to measure variance in math performance. In addition, the Dunnett Multiple Comparisons test was used as a post hoc procedure for attitude and anxiety, and the Schaffee test was used to compare the variance in mathematic performance.

The results showed that at the end of the sixth week posttesting period, all three groups produced significant improvement in math anxiety levels. Additionally, only the hypnotherapeutic restructuring treatment created significant postitive changes in attitude toward mathematics and, by the end of the 12-week grading period, produced significant improvements in math performance.

The theoretical position, upon which the HR treatment was based, began with one general assumption. That mathematics anxiety is a learning problem. That the ability to use mathematics requires the capacity to attend to new information, to store the information in an organized pattern, to associate common elements together and to retrieve and manipulate the information purposefully. Persons displaying mathematics anxiety appear to lack these organizational abilities. New information is not organized into the whole, associations are often mispaired, new information is either lost or filtered out altogether and recall from long-term memory is generally disorganized and/or incomplete.

The hypnotherapeutic treatment program in the study was designed to restructure the cognitive schema of mathematics anxiety victims. (The assumption that mathematics anxiety is an organizational disability associated with mathematics (cognitive schema) which is a developmental

product of past experiences with teachers and tests, peer pressures and attitudes, failures in math courses and general avoidance.) In effect, the purpose was to convince each subject of the HR treatment condition that mathematics is valuable, logical, comprehensible, and under their control.

Based upon the results of the study, it is believed that mathematics anxiety is: a developmental-organizational disability involving the storage, retention, retrieval, and purposeful manipulation of mathematical elements; generally accompanied by an avoidance reaction.

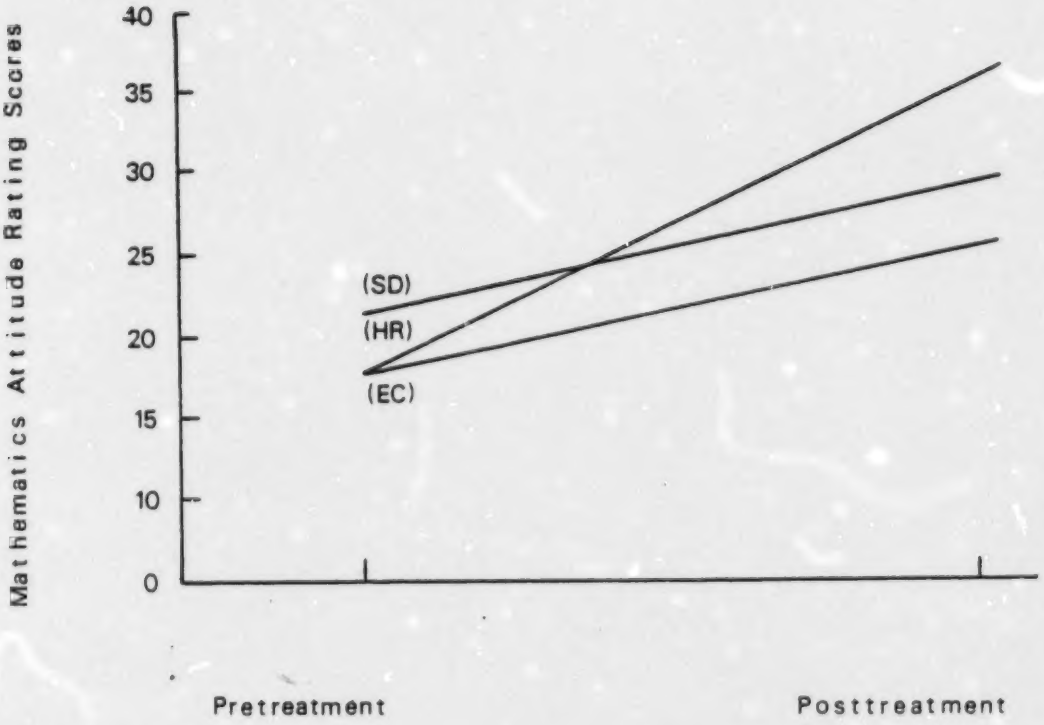

Figure 1 Pretreatment and Posttreatment Mathematics Attitude scores for Systematic Desensitization (SD), Hypnotherapeutic Restructuring (HR), and Expectancy Control (EC).

Table 1

Means and Standard Deviations for Mathematics Anxiety: Groups by Pre-Posttesting

	Anxiety					
	Pretreatment			Posttreatment		
	N	MEAN	SD	N	MEAN	SD
Group						
Males	4	313.50	48.45	4	208.50	50.55
Females	8	284.90	34.56	8	207.00	54.94
group (SD)	12	294.25	41.43	12	207.50	51.17
Males	4	268.5	19.33	4	163.25	36.61
Females	8	332.8	77.03	8	196.00	37.08
group (HR)	12	311.40	69.69	12	185.08	36.76
Males	4	293.30	29.05	4	234.30	63.52
Females	8	312.40	50.82	8	229.60	74.11
group (EC)	12	306.00	44.55	12	231.00	67.71
All males	12	291.50	38.88	12	202.00	55.78
All Females	24	310.00	58.13	24	210.90	56.56
All Subjects	36	303.90	52.38	36	207.90	55.74

Table 2

Summary Table of Analysis of Variance Showing the Effects of Treatments, Gender and Pre-Posttesting on Mathematics Anxiety (N = 36)

Source	df	Sum of Square	Mean Square	F
Between Subjects	35	121778.8		
Treatment Conditions (A)	2	5871.3416	2935.6708	.86
Gender (B)	1	2099.4249	2988.4949	.88
(AxB)	2	11039.834	5519.917	1.63
S/AB (Error)	30	101879.2	3395.9733	
Within Subjects	36	248555.5		
Pre-Post-testing (C)	1	165792.0	165792.0	70.04**
(AxC)	2	8722.2584	4361.1292	1.84
(BxC)	1	367.3751	367.3751	.16
(AxBxC)	2	2663.366	1331.683	.56
SC/AB	30	71010.501	2367.0167	
TOTAL	71	370334.3		

**$p<.01$

Table 3

Means and Standard Deviations for Attitude Toward Mathematics: Groups by Pre-Posttesting

	Pretreatment			Posttreatment		
	N	MEAN	SD	N	MEAN	SD
Group						
Males	4	26.50	8.10	4	29.00	15.85
Females	8	20.80	16.35	8	29.01	12.68
group (SD)	12	22.70	13.21	12	29.00	13.09
Males	4	24.00	10.36	4	40.00	16.87
Females	8	16.10	13.07	8	34.40	9.33
group (HR)	12	18.80	12.26	12	36.30	11.19
Males	4	12.30	6.21	4	25.00	14.04
Females	8	22.00	14.17	8	28.60	15.02
group (EC)	12	18.75	12.72	12	26.40	14.16
All males	12	20.90	11.71	12	31.30	15.68
All Females	24	19.60	13.87	24	30.70	12.23
All Subjects	36	20.00	12.56	36	30.90	13.23

Table 4

Analysis of Variance Summary Table
for Attitude Toward Mathematics

Source	df	Sum of Square	Mean Square	F
Between Subjects	35	9279.486		
Treatment Condition (A)	2	329.52767	164.764	.58
Gender (B)	1	14.69433	14.694	.05
(AxB)	2	509.01433	254.507	.89
S/AB (Error)	30	8516.25	283.875	
Within Subjects	36	4476.5		
Pre-Post-testing (C)	1	2123.3471	2123.347	34.65**
(AxC)	2	411.86123	205.931	3.36*
(BxC)	1	1.777	1.777	.02
(AxBxC)	2	101.01358	50.507	.87
SSc/AB	30	1838.5011	61.283	
TOTAL	71	13755.986		

*$p<.05$
**$p<.01$

Table 5

Trend Analysis for Mathematic Testing Performance Scores by Treatments by Trials Regression Format

Source	df	Sum of Square	Mean Square	F
Treatment Groups	2	7500.44	3750.22	3.70*
Error (BS)	33	33403.38	1012.24	
Trials (Trend)	5	5645.61	1129.12	6.07**
Treatment by Trials	10	1859.27	185.92	1.00
Error (WS)	165	30633.78	185.65	
TOTAL	215	79042.5		

*$p < .05$
**$p < .01$

Table 6

Scheffe's Test for Variable: Performance Scores

ALPHA = 0.01 DF = 33 MSE = 1012.223

Critical Value of T = 5.13

Means with the same letter are not significantly different.

Group	Mean	N	Scheffe Grouping
*B	72.750	72	A
C	60.194	72	B
A	60.306	72	B

*p<.01

Table 7

Means and Standard Deviations for Performance Scores: Groups by Trials

	Group								
	Systematic Desensitization			Hypnotherapeutic Restructuring			Expectancy Control		
	N	MEAN	SD	N	MEAN	SD	N	MEAN	SD
Trials									
1	12	46.33	24.21	12	70.58	15.96	12	53.33	25.44
2	12	58.40	11.08	12	67.25	12.84	12	56.08	18.44
3	12	69.92	6.52	12	80.50	8.93	12	62.50	20.82
4	12	58.30	12.13	12	69.33	13.25	12	60.41	16.72
5	12	62.00	19.36	12	72.40	12.86	12	65.50	13.42
6	12	72.60	17.77	12	76.40	9.54	12	63.33	24.90
Total	72	60.30	20.96	72	72.75	12.79	72	60.19	19.20

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